

CLAIMS

We claim:

1. An optical device comprising:

a freestanding membrane comprising a plurality of thin-film layers represented by $L(i)$, $i=1, 2, 3, \dots, N$ where N is a positive odd integer; and

said membrane having a mirror symmetrical layer structure relative to a middle layer $L(m)$ where $m=(N+1)/2$, and layer $L(m-j)$ and layer $L(m+j)$ having a same thickness, material composition, shape and size, where $j=1, 2, 3, \dots, (N-1)/2$.

2. The optical device of claim 1 further comprising:

an electromagnetic means for controlling and moving said freestanding membrane.

3. The optical device of claim 1 wherein:

said layers $L(i)$ having an alternate high-low refraction index configuration with layers $L(i_H)$ having a set of relatively higher refraction indexes and layers $L(i_L)$ having a set of relatively lower refraction indexes where $i_H = 1, 3, 5, N$ and $i_L = 2, 4, 6, \dots, (N-1)$.

4. The optical device of claim 1 wherein:

said layers $L(i)$ having an alternate high-low refraction index configuration with layers $L(i_H)$ having a set of relatively higher refraction indexes and layers $L(i_L)$ having a set of relatively lower refraction indexes where $i_L = 1, 3, 5, \dots, N$ and $i_H = 2, 4, 6, \dots, (N-1)$.

5. The optical device of claim 1 further comprising:
- a resonant cavity supported on a silicon substrate covered by said freestanding membrane.
6. The optical device of claim 5 further comprising:
- an antireflection (AR) layer coated on the bottom of said silicon substrate.
7. The optical device of claim 1 wherein:
- at least one of said layers $L(i)$, $i=1, 2, 3, \dots, N$, is a polysilicon layer.
8. The optical device of claim 1 wherein:
- at least one of said layers $L(i)$, $i=1, 2, 3, \dots, N$, is a silicon nitride layer.
9. The optical device of claim 1 further comprising:
- a HR coating layer coated on said freestanding membrane.
10. A freestanding membrane comprising:
- a plurality of thin-film layers represented by $L(i)$, $i=1, 2, 3, \dots, N$ where N is a positive odd integer; and
- said thin film layers having a mirror symmetrical layer structure relative to a middle layer $L(m)$ where $m=(N+1)/2$, and layer $L(m-j)$ and layer $L(m+j)$ having a same thickness, material composition, shape and size, where $j=1, 2, 3, \dots, (N-1)/2$.

11. An method for manufacturing an optical device comprising:

forming a freestanding membrane with a plurality of thin-film layers represented by $L(i)$, $i=1, 2, 3, \dots, N$ where N is a positive odd integer; and

configuring said thin film layers with a mirror symmetrical layer structure relative to a middle layer $L(m)$ where $m=(N+1)/2$, and layer $L(m-j)$ and layer $L(m+j)$ having a same thickness, material composition, shape and size, where $j=1, 2, 3, \dots, (N-1)/2$.

12. The method of claim 11 further comprising:

controlling and moving said freestanding membrane with an electromagnetic means.

13. The method of claim 11 wherein:

said step of configuring said thin film layers further comprising a step of configuring said layers $L(i)$ with an alternate high-low refraction index configuration with layers $L(i_H)$ having a set of relatively higher refraction indexes and layers $L(i_L)$ having a set of relatively lower refraction indexes where $i_H = 1, 3, 5, N$ and $i_L = 2, 4, 6, \dots, (N-1)$.

14. The method of claim 11 wherein:

said step of configuring said thin film layers further comprising a step of configuring said layers $L(i)$ with an alternate high-low refraction index configuration with layers $L(i_H)$ having a set of relatively higher refraction indexes and layers $L(i_L)$ having a set of relatively lower refraction indexes where $i_L = 1, 3, 5, \dots, N$ and $i_H = 2, 4, 6, \dots, (N-1)$.

15. The method of claim 11 further comprising:

supporting a resonant cavity on a silicon substrate and
covering said resonant cavity with said freestanding
membrane.

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16. The method of claim 11 further comprising:

coating an antireflection (AR) layer on the bottom of said
silicon substrate.

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17. The method of claim 11 wherein:

said step of configuring said thin-film layers further
comprising a step of forming a polysilicon layer for at least
one of said layers $L(i)$, $i = 1, 2, 3, \dots N$.

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18. The method of claim 11 wherein:

said step of configuring said thin-film layers further
comprising a step of forming a silicon nitride layer for at
least one of said layers $L(i)$, $i = 1, 2, 3, \dots N$.

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19. The method of claim 11 further comprising:

coating a HR coating layer on said freestanding membrane.

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20. A method of forming a freestanding membrane comprising:

forming a plurality of thin-film layers represented by $L(i)$,
 $i=1, 2, 3, \dots, N$ where N is a positive odd integer; and

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configuring said thin film layers with a mirror symmetrical
layer structure relative to a middle layer $L(m)$ where
 $m=(N+1)/2$, and layer $L(m-j)$ and layer $L(m+j)$ having a
same thickness, material composition, shape and size, where
10 $j=1, 2, 3, \dots, (N-1)/2$.

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